FSTC-HT-23-443-69

U.S. ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER

THE STUDY OF THE CONCENTRATIONS OF LONG-DURATION

RADIOACTIVE AEROSOLS OF ATMOSPHERIC

AIR IN ITS RELATION TO THE AMOUNT OF DUST

COUNTRY: USSR

TECHNICAL TRANSLATION

9

TECHNICAL TRANSLATION

FSTC-HT-23- 443-69

THE STUDY OF THE CONCENTRATIONS OF LONG-DURATION RADIOACTIVE AEROSOLS OF ATMOSPHERIC AIR IN ITS RELATION TO THE AMOUNT OF DUST

by

M. V. KOZLOVA, Candidate of Technical Science,
I. P. KORENKOV, Candidate of Medical Science,
YU. V. NOVIKOV and D. D. GRANOVSKAYA

The Moscow Municipal Epidemic Hospital and The Moscow Scientific Research Institute of Hygiene called F. F. Erisman
USSR

Translated for FSTC by Techtran Corporation

THE STUDY OF THE CONCENTRATIONS OF LONG-DURATION
RADIOACTIVE AEROSOL OF ATMOSPHERIC
AIR IN ITS RELATION TO THE AMOUNT OF DUST

Radioactive substances are found in the air in the form of aerosols. The diameter of the latter particles is equal to tenths and hundreds of a micron. These small particles of the products of division, which are carried great distances by air currents, settle out on larger ones which are always present in the surface layer of the atmosphere of air, converting them in this way to radioactive particles (N. A. Susorova; Eisenbud and Harley).

We were not able to find data in technical literature on the study of the correlation between the concentrations of long-duration aerosols in the surface layer of the atmosphere and the amount of dust in it. In addition, this question has a certain hygienic significance. It is well known that an increase in the concentration of atmospheric dust containing stable isotopes can lead to a decrease in the specific activity of dust hovering in the air. In the given case, stable atmospheric dust appears in the roll of a factor which reduces the amount of radioactive substances in the atmosphere of air. Since it is necessary to take this condition into consideration in the hygienic evaluation of the radioactive contamination of the atmospheric air, we carried out as an experiment a determination of the concentration of long-duration radioactive substances and dust of the atmospheric air in Moscow.

We took samples with the help of a special aspiration device UAS-1 (V. P. Rublevskiy) equipped with a FPP-15 filter. The area of the filter was 5500 cm^2. The volume of filtered air on the average came to 1200 m^3. During 1965 seventy-eight samples of atmospheric air were taken for tests of radioactivity and the content of stable dust at an altitude of 15 meters over soil covered with asphalt.

The concentration of dust in one cubic meter of air was determined by preliminary weighing of the filter after the action of the aspirator was turned off. Weighing was accomplished after first leaving the filter in a desiccator for two days. In addition, the filter was heated in the muffle furnace at 400°C. With the aim of determining the concentration of long-duration β-active aerosols, we took a weight sample of 10 mg of an obtained quantity of ash and applied it to the standard aluminum footboard; then on the DP-100 device with a BFL T-25 counter, we determined the total activity of the samples being investigated.

The specific β-activity of the long-duration aerosols (A) in curie for one liter was determined according to the following formula:

$$A = \frac{(N - N_{\Phi}) \cdot p_2}{2{,}2 \cdot 10^{12} \cdot V \cdot k \cdot p_1},$$

where N is the rate of calculation (per minute) from the samples being investigated, N_f is the phon of the device (per minute), v is the volume of the air drawn in (in liters); k is the effectiveness of the counting mechanism determined with the help of K^{40} (N. A. Susorova), p_1 is the correction for self-absorption in the preparation, p_2 is the correction for brake-through of the aerosols by means of the FPP-15 (10%).

The results of the investigation of the concentrations of β-active long-duration aerosols and dust of the atmospheric air are shown in the figure. From this figure it is clear that the amount of contamination of the atmospheric air by β-active long-duration aerosols in 1965 was at a level of ~ 1-9 · 10^{-17} curie/per liter. The concentration of dust in the surface layer of the atmosphere was in the range of 0.03 - 0.7 mg/m^3. Judging from the drawing, a direct relationship of the concentrations of the β-active aerosols to the amount of dust in the air was noted at different

months. For example, on the 13th of January, 12th of April, the 23rd and 28th of July, and on other days when there was an increase in the amount of dust in the atmospheric air, the concentrations of radioactive aerosols in it increased. In other cases (on 31 March, 19 April, 5 May etc.) such a relationship was not observed.

Taking these data into consideration, we set out to determine the relationship between the concentrations of radioactive substances and the amount of dust in atmospheric air by using the method of correlation analysis (A. M. Dlin). With this aim, we used the correlation grid for results of measurement and constructed the empirical line of regression which was expressed by the equation:

$$y_x = f(x),$$

where y is the average concentration of radioactive substances in atmospheric air, x is the amount of dust in the air.

The theoretical line of regression as the form:

$$y = ax + b$$

where y is the concentration of the radioactive aerosols (in curie/liter), X is the amount of dust in the air (in mg/m^3), a and b are the coefficients for the equation of regression; a is the amount of dust in the air (in mg/m^3) at a concentration of radioactive substances (in curie/liter), b is the concentration of radioactive substances in the air in the absence of dust.

In our investigations, the analytic expression for the theoretical line of regression had the form:

$$y = 6{,}6x + 3{,}5,$$

where a = 6.6, b = 3.5.

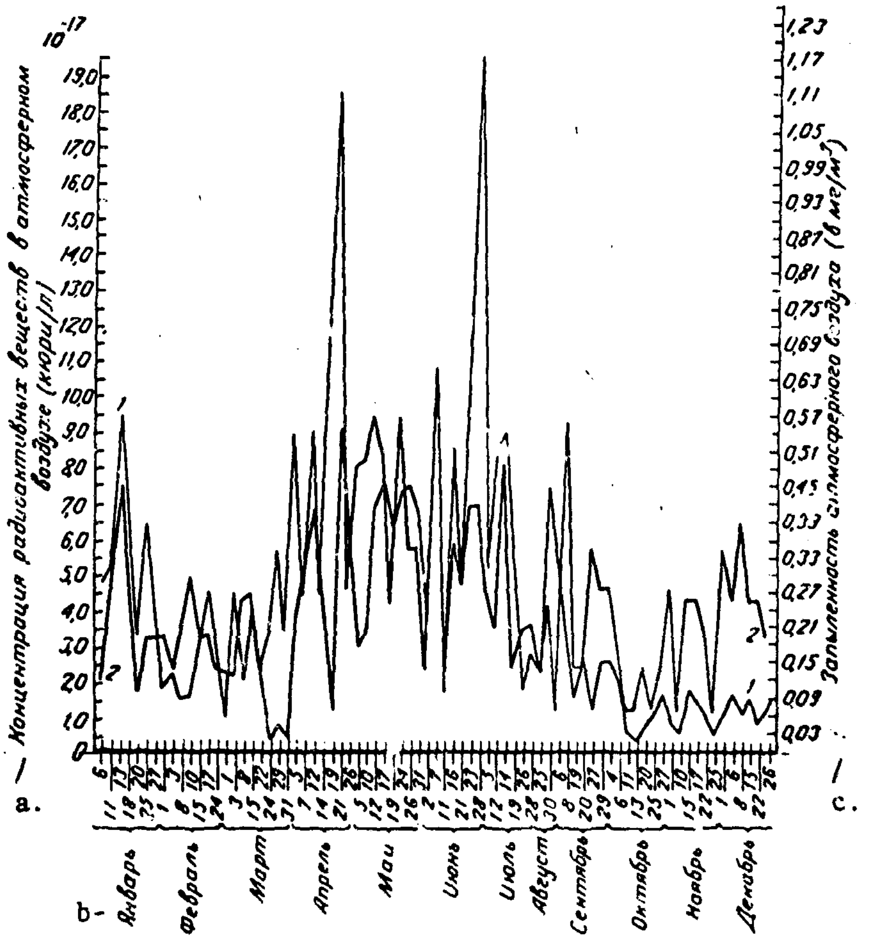

Fig. 1. Concentration of long-duration β-active aerosols (1) and hovering dust (2) in the atmospheric air of Moscow in 1965.

Key: a. Concentration of radioactive substances in the atmospheric air (curie/liter); b. Jan., Feb. March, April, May, June, July Aug., Sept., Oct., Nov., Dec: c. Amount of dust of the atmospheric air (in mg/m^3).

The coefficient of correlation was determined according to the formula:

$$r = a\frac{\sigma_x}{\sigma_y},$$

where: $$\sigma_x = h_x \cdot \sqrt{\frac{\sum m_x \cdot x'^2}{\sum m_x} - \left(\frac{\sum m_x \cdot x'}{\sum m_x}\right)^2},$$

$$\sigma_y = h_y \cdot \sqrt{\left(\frac{\sum m_y \cdot y'}{\sum m_y}\right)^2 - \left(\frac{\sum m_y \cdot u'}{\sum m_y}\right)^2}.$$

σ_x and σ_y is the dispersion of the values x and y, h_x is the step of the integrals according to x, h_y is the step of the integrals according to y, m_x and m_y are partial sums.

Introducing the data from the correlation tables, we find the coefficient of correlation. In our case, it was equal to +0.4 ± 0.08.

Thus, a correlation relationship was found between the amount of dust of atmospheric air and the concentrations of long-duration aerosols. This mutual relationship expressed by the coefficient of correlation with a plus sign, has a proportional character. In spite of the fact that the coefficient of correlation obtained by us was not very close to unity, the error in determining it amounts to σ_r = ± 0.05, which points to an existing mutual relationship.

BIBLIOGRAPHY

1. Dlin, A. N., *Matematicheskaya Stapistika v Tekhnike*, Moscow, 1958.
2. Rublevskiy, V. P., *Gigenita and Sanatgagsiya*, No. 9, p. 60, 1964.
3. Susorova, N. A., *Radioaktivnye Zagryaznen'ya Vneshney Sredy*, Moscow, p. 9, 1962.
4. Eisenbud, M. and Harley, J. H., Science, vol. 124, p. 251, 1956.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Foreign Science and Technology Center US Army Materiel Command Department of the Army	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE

THE STUDY OF THE CONCENTRATIONS OF LONG-DURATION RADIOACTIVE AEROSOLS OF ATMOSPHERIC AIR IN ITS RELATION TO THE AMOUNT OF DUST

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Translation

5. AUTHOR(S) (First name, middle initial, last name)

M. V. Kozlova, Candidate of Technical Science; I. P. Korenkov, Candidate of Medical Science; Yu. V. Novikov and D. D. Granovskaya

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
18 September 1969	5	N/A

8a. CONTRACT OR GRANT NO. b. PROJECT NO. c. 02RD500 2301 d. USAECOM (WSMR)	9a. ORIGINATOR'S REPORT NUMBER(S) FSTC-HT-23-443-69 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) ACSI Control Number (None)

10. DISTRIBUTION STATEMENT

This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	US Army Foreign Science and Technology Center

13. ABSTRACT

This article presents materials on the study on the mutual relationship between concentrations of long-duration aerosols and the amount of dust in atmospheric air. It was found that this mutual relationship has a proportional character.

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Radioactive aerosols						
Atmospheric air						

UNCLASSIFIED
Security Classification

U.S. GOVERNMENT PRINTING OFFICE